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APPLICATION OF INDICATOR CULL FACTORS TO WHITE AND RED FIR STANDS IN THE SIERRA NEVADA

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Recent checks show that indicator cull factors developed for white fir (Abies concolor (Gord. & Glend.) Lindl.) and red fir (A. magnifica A. Murr.) in northwestern California [1] apply equally well to these two species in the Sierra Nevada.

Cull factors of the indicator type, which are based on external indications of cull and apply to individual trees, have broad application. For this reason, the Experiment Station assumed that indicator factors for the firs would apply throughout the State. The validity of this assumption had not been proved, however, and some foresters questioned the accuracy of factors derived from measurements in one subregion when applied to trees in another subregion. To answer the question, the factors were tested on two sets of fir trees in the Sierra Nevada.

METHODS AND BASES OF TESTS

White fir.--Early dissection studies of cull in white fir at two locations on the Sierra National Forest provided readily available cull data for checking the applicability of the cull factors to that tree species. Actual cull volumes had been determined at Madsen Mill east of Shaver Lake, where 257 trees were dissected, and at Ellis Meadow northeast of North Fork, where 276 trees were dissected. To test the cull factors, they were applied to the dissected trees, and the cull volumes thus computed were compared with the actual cull volumes determined in the dissection studies.

Red fir.--In 1955 cull studies were made in red fir stands at 16 locations on the Eldorado, Tahoe, and Plumas National Forests where logging was being conducted. The cull volumes of 258 individual trees were carefully determined after the trees were felled and bucked. Later these measured volumes were compared with the cull volumes computed by applying the indicator factors to these same study trees.

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[1] Kimmey, James W. Cull factors for forest-tree species in northwestern California. California Forest and Range Experiment Station, Forest Survey Release No. 7. 30 pp., illus. 1950.

RESULTS

The accuracy of the cull factors proved satisfactory when applied to the true firs in the Sierra Nevada. For the gross board-foot volume in the sawlog portion of the bole, the factors showed 10.2 percent cull on all sites combined, against 9.2 percent actual cull, in white fir trees (table 1). In red fir the differences amounted to 2 percent cull.

The checks showed that the factors for determining the cull percentage of the gross cubic-foot volume of the entire stem were even more accurate. For both white fir and red fir the estimated values were within 0.5 percent cull of that actually measured.

Table 1.--Actual 1/ and estimated 2/ percent of gross volume that is cull in white fir and red fir, by site index, Sierra Nevada, California

Site index, feet	Sawlog portion of bole (stump to utilized top)				Entire bole (stump to 4-in. d.i.b. top)		Basis	
	Bd.-ft. volume		Cu.-ft. volume		Cu.-ft. volume			
	Actual	Est.	Actual	Est.	Actual	Est.	Localities	Trees
	Percent cull						No.	No.
WHITE FIR								
175	7.6	6.3	3.2	2.9	3.3	3.0	1	257
125-150	12.6	18.1	7.2	6.6	7.1	6.3	1	276
All	9.2	10.2	4.6	4.2	4.6	4.2	2	533
RED FIR								
200	18.0	16.4	6.3	8.9	9.1	10.2	2	20
175	16.2	19.2	7.2	10.2	11.2	11.4	6	78
125-150	27.2	29.6	14.4	14.6	15.0	14.1	10	160
All	22.3	24.3	10.9	12.4	12.9	12.6	16	258

1/ Actual cull percentages determined through cull studies.

2/ Cull percentages estimated by applying cull factors.

DISCUSSION

When applied to 533 trees at two locations, the cull factors gave more accurate results than when applied to 258 trees at 16 locations. This fact indicates that the number of sample trees has a greater bearing on the accuracy of the factors than the number of locations sampled. It also demonstrates the reliability of the indicator factors in localized areas. In other words, the factors will give accurate cull percentages on any area if the number of sample trees is adequate.

All indicator cull factors vary in magnitude with site and tree diameter. Table 1 lists cull percentages by site index to provide some idea of the applicability of the cull factors to different sites in California, but the number of trees sampled for any one diameter at a given site probably was not sufficient to determine the true accuracy of the factors for that site.

To indicate the variation with tree size, all red firs in the cull study were grouped by d.b.h. classes regardless of site (fig. 1). This grouping showed no consistent unconformity between the actual and the estimated cull percentages, and the degree of conformity appeared to be directly correlated with the number of trees in a diameter class. Thus, no bias exists in the cull factors, and if the number of study trees in each class were large enough, the two lines on each graph would approximately coincide.

In white and red fir trees of the Sierra Nevada open bole wounds or "cankers" caused by dwarfmistletoe (fig. 2) are more prevalent than in northwestern California. The cull studies in the Sierra indicated that the defect from these cankers was similar in amount to that from open fire scars, lightning wounds, and other open wounds. Cruisers should distinguish these open cankers, however, from the younger bole infections of dwarfmistletoe known as "burls" (fig. 3), which are unopened swellings and contain no appreciable amount of decay.

CONCLUSION

This check of indicator cull factors for white and red fir developed for northwestern California leaves no doubt of their adequacy for estimating cull in the Sierra Nevada. An analysis of the test results leads us to believe that these indicator factors will apply equally well wherever red and white firs occur in the State.

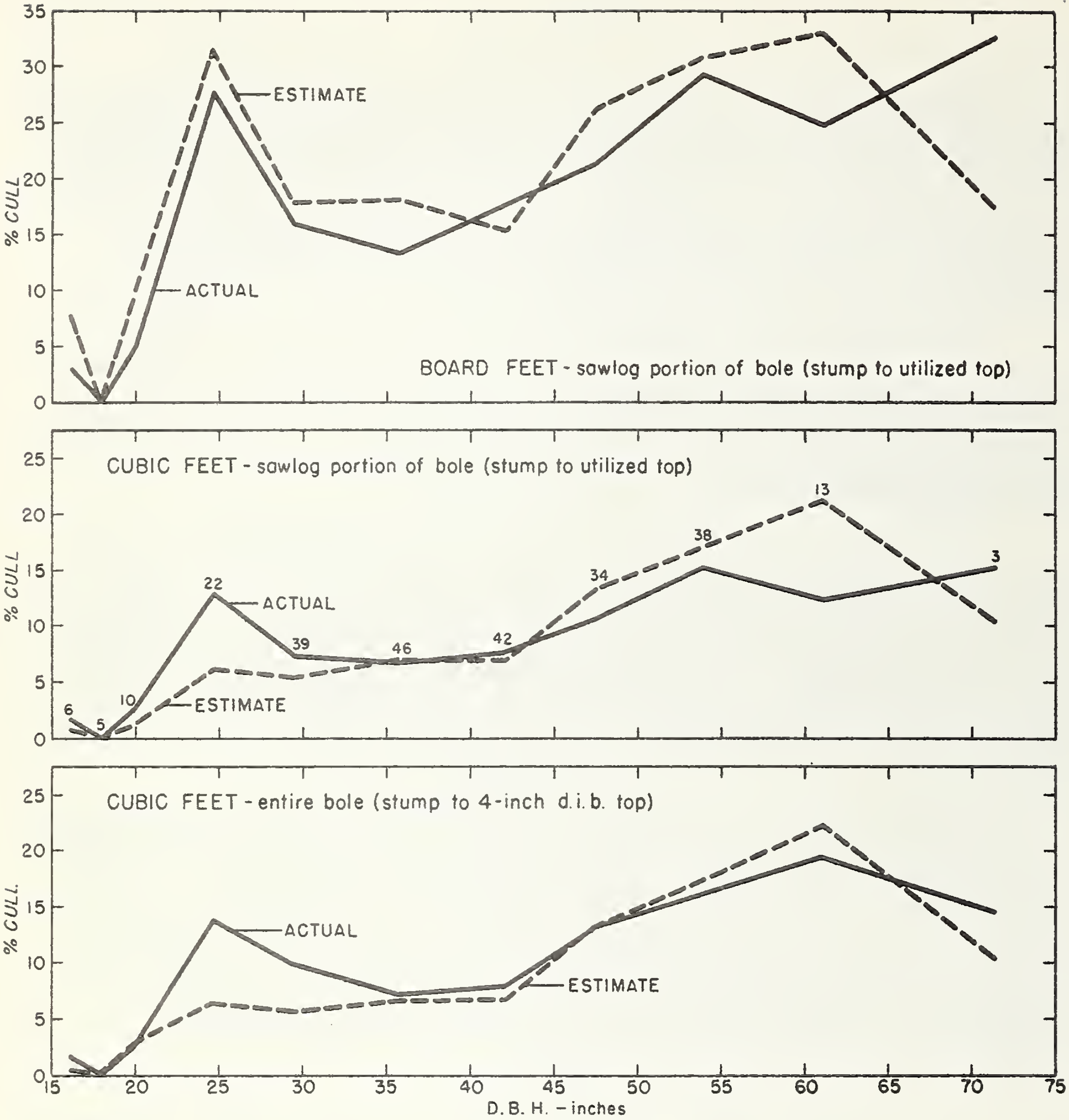

Figure 1.--Actual and estimated cull percentages in 258 red fir trees, by diameter class, from 4 different sites on 16 areas in the Sierra Nevada. The number of trees measured in each diameter class is shown on the center graph.

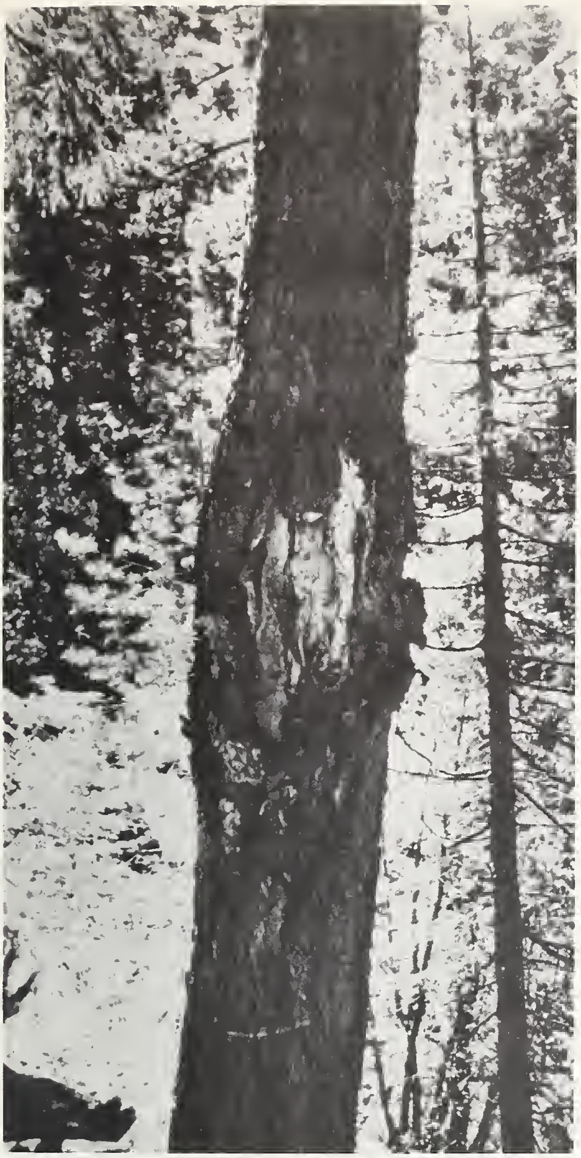

Figure 2.--Open bole wound caused by dwarfmistletoe canker on old-growth white fir tree. This cull indicator is common on both white and red fir trees in the Sierra Nevada forests. Cull factor is the same as for open fire scar or other open wound.

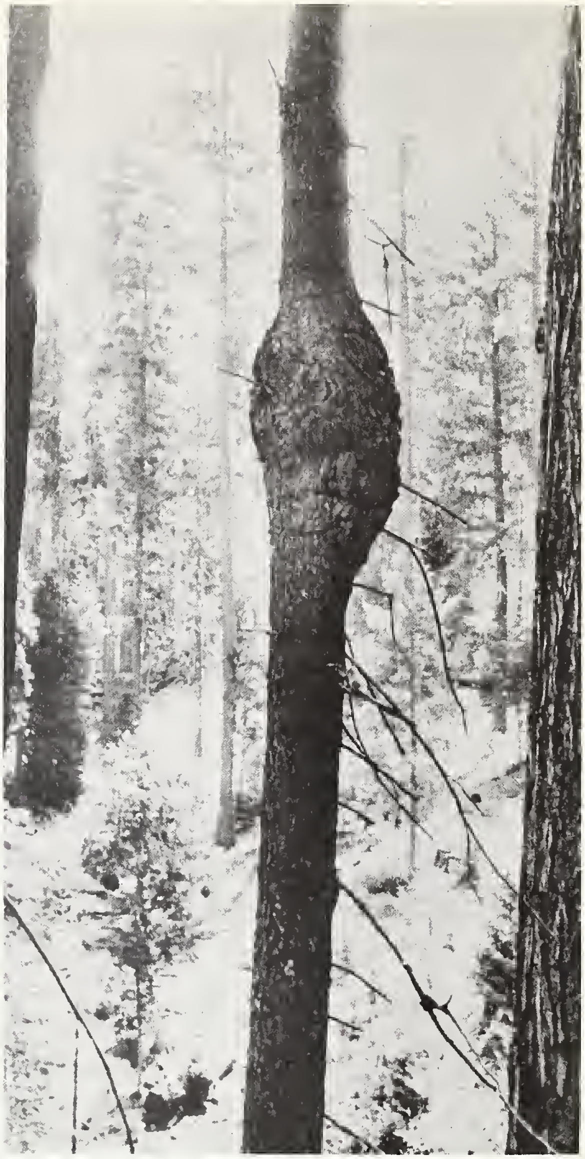

Figure 3.--Swelling on young white fir tree caused by dwarfmistletoe bole infection. This type of swelling with unbroken bark covering is known as a "burl" and does not indicate decay or other cull of significance.